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AGRICULTURAL NEWS LETTER

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This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

In addition to reporting results of the investigations of the Company and its subsidiaries, published reports and direct contributions of investigators of agricultural experiment stations and other institutions are given dealing with the Company's products and other subjects of agricultural interest.

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AGRICULTURAL NEWS LETTER

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IMPORTANT TO READERS

After careful consideration it has been decided that the purpose of the Agricultural News Letter can best be served by publication every other month, instead of monthly.

EDITOR

Agricultural News Letter (du Pont)
Vol. 7, Nos. 4 and 5, April-May, 1939

A SYNTHETIC COMPOST FOR MUSHROOM GROWING DEVELOPED BY THE PENNSYLVANIA AGRICULTURAL EXPERIMENT STATION

EDITOR'S NOTE:- Of economic importance to commercial growers is the fact that straw, urea and wheat have been found to be satisfactory basic ingredients for synthetic compost for mushroom culture.

The Pennsylvania Agricultural Experiment Station, in Bulletin 365 by J. W. Sinden, reports results of its experimental work in developing a procedure for making a satisfactory compost or artificial manure for use in commercial growing of mushrooms.

This experimental work was considered of importance for two reasons: (1) the uncertainty and insufficiency of horse manure, heretofore essential for the growing of mushrooms on a commercial scale; and (2) the fact that in no case have the various composts heretofore used been very satisfactory, making their commercial use inadvisable.

It was recognized from the start that, while manure which is to be distributed in the soil should add as large an amount of nitrogen, phosphate and potash as possible, the primary purpose of a mushroom compost is to supply abundant carbon compounds, since the mushrooms cannot manufacture these substances from carbon dioxide and water as do the green plants. It is also imperative that the finished compost promote the growth of mushrooms to the exclusion of other fungi and bacteria.

Why Straw, Urea, and Wheat Were Used

Straw, urea, and wheat were used as basic ingredients for the following reasons:

Straw is abundantly available in most localities, and forms the bulk of the horse manure used in mushroom growing.

Urea contains 46% nitrogen and is readily decomposed by the action of microorganisms into ammonia and carbon dioxide, leaving no inorganic residue which might interfere with the decomposition process, or of mushroom development later.

Wheat is a convenient form of grain, and if it proved a valuable addition to the compost, grain by-products such as bran, wheat screenings, brewers' and distillers' grains, and smutty or soft wheat can be substituted at a cost low enough to be commercially practical.

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Character of Finished Compost

The finished compost is similar in texture and odor to composted horse manure, but differs principally in its greater bulk per unit weight. Consequently, a thicker layer is needed in the beds to give a weight of organic matter equal to that of horse manure. Because of its looser structure, the synthetic compost is more subject to drying in the pile and in the bed.

This lack of compactness has the advantage of allowing better aeration of the compost. The compost can, therefore, have a higher moisture content than horse manure without interfering with mycelial development of the mushrooms. By chopping the straw in a hay chopper or ensilage cutter before starting the compost, the density of the finished material will approach that of horse manure.

Experimental Procedure

A suggested procedure for making such a compost for growing mushrooms commercially, based on the experimental results obtained, is included in detail in the bulletin. The piles were composted in the open air, and removed to the experimental house at the Experiment Station provided by the Mushroom Growers Cooperative Association of Pennsylvania. Each plot was then filled with a definite weight of finished compost. Six variations of compost were compared in five replications. The plots were randomized, except that each treatment appeared in every row of plots but one. In later experiments only five types of compost were compared in six replications, each material then appearing in each row of beds.

In determining the effect of the addition of different amounts of urea to the compost pile, the time of composting and the amount of wheat added remained constant. Each pile contained 500 pounds of baled straw, thoroughly wetted and tramped. After 6 days, urea was added, at the following rates per 1,000 pounds of straw: none, 8 pounds, 16 pounds, 24 pounds, and 32 pounds. Another pile consisted of 1 ton of horse manure which was started to compost at the same time the urea was added to the synthetic piles.

All piles were turned again after 6 days, and 100 pounds of wheat, dampened 24 hours previously, added to each straw pile. The piles were given three more turnings at intervals of 7,8, and 8 days, respectively. The composting was done during November and December, and the piles had no protection from strong northwest winds, making composting slow. The straw lay a total of 44 days before it was placed in the beds, or 27 days after the wheat was added. The manure lay 38 days. The beds were planted with grain spawn 5 days after they were filled, and were cased 23 days after the spawn was planted. Because of lack of temperature control equipment, the temperature was inadvertently allowed to rise above 90°F. for several days before the casing soil was applied. The drying effect of this high temperature materially reduced the yields except on the beds containing manure, which being more compact, did not lose moisture so rapidly.

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Results

Among the important results obtained were the following:

A synthetic compost made up of straw, urea, and wheat produced 444 pounds of mushrooms per ton of straw, or nearly as much as horse manure produced. The slight difference is probably due chiefly to the fact that the manure did not lose moisture as rapidly as did the synthetic compost when the temperature was inadvertently allowed to rise too high.

Neither wheat nor urea may be omitted from the compost without materially decreasing the yield of mushrooms.

Further, any one of the three ingredients may be added to the available horse manure to compensate for a deficiency, although grain should be added only when it is known that the horses have been fed a ration deficient in concentrates.

The addition of wheat to synthetic compost resulted in more rapid decomposition than when no wheat was present. The piles with wheat added all produced more mushrooms than the one without.

The rate of decomposition of synthetic compost increases as the amount of urea is increased until 32 pounds are present per ton of straw. When more urea than this is added, the rate of decomposition decreases. The most satisfactory compost contained the optimum amount of urea for decomposition. However, more than 32 pounds of urea per ton of straw could undoubtedly be added without interfering with the composting rate over a period of several weeks rather than all at once.

Effect of Composting Time on Efficiency of Compost

In order to develop information regarding the effect of the composting time on the efficiency of artificial manure, piles consisting of 500 pounds of wheat straw, 8 pounds of urea, and 120 pounds of wheat were used. The piles were started by watering and compressing the straw. Four days later urea was added. Four days later the wheat was added. The piles were turned at 8-day intervals until the end of the experiment.

The piles composted 21 and 25 days produced more mushrooms than those composted longer. The number of turnings and the total time of composting depend entirely on the rate of decomposition, which is not only affected by the amounts of urea and wheat added, but by moisture and compactness, as well. However, the results of these experiments cast some doubt on the value of extensive decomposition. It was found that satisfactory crops may be grown on straw that is scarcely decomposed, provided it is chopped fine enough to pack quite densely into the beds.

General Conclusion

While it will be necessary to refer to the bulletin, which may be obtained from the Pennsylvania Experiment Station, State College, Pa., for details of procedure and results of the various phases of the experiment, it can be said here

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that the experiments show that a satisfactory synthetic compost or artificial manure for mushroom culture may be made by using wheat straw, wheat, and urea as the basic ingredients.

Practical Application

The bulletin points out that "each grower must determine for himself the economy of using any of these ingredients, or whether he can afford to use synthetic compost at all, since the cost must necessarily be high in comparison to manure when that is plentiful. He may find, however, as some have, that a properly-made synthetic compost added to manure will assure him more uniform yields year in and year out than will manure alone. In such a case, the cost of the synthetic compost, if it approximates that of manure, is of secondary consideration."

The bulletin also cautions the grower not to make extensive trials of synthetic compost without first working with small lots until he has familiarized himself with the details and assured himself of its possibilities under his conditions.

"Neither should he condemn it because of initial failure. Many of the practices the grower has found essential to successful mushroom culture on horse manure must be modified if he is to have similar success with synthetic compost."

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METHOD DEVELOPED FOR RIDDING CLOTHES MOTH CULTURES OF PREDACIOUS MITES TO OBTAIN UNIFORM LARVAE AND ADULTS

EDITOR'S NOTE:- Investigators in the field of mothproofing will be interested in the important phase of rearing clothes moths, Tineola biselliella (Hum), which is described here.

By A. H. Goddin, Entomologist,
Pest Control Research Laboratory,
E. I. du Pont de Nemours & Co., Inc.,
Wilmington, Delaware.

Large numbers of clothes moths are reared by entomologists in their study of chemicals designed to prevent damage to wool and other keratinous materials by fabric insects. Clothes moth larvae must be uniformly vigorous and healthy if mothproofing tests are to be accurate and reproducable. The experience of the entomologists of the Du Pont Pest Control Research Section in maintaining satisfactory cultures may be of interest to other investigators in the field of mothproofing. Over a period of three years, it has been observed that predacious mites become numerous and troublesome in clothes moth cultures during periods in which they are inspected at infrequent intervals. This condition results in reduced vitality of the insects. The mite has been identified by the U.S.D.A., Division of Insect Identification* as belonging to the subfamily Parasitinae and to belong in a genus near Seiulus.

Adult mites are similar in size and shape to the egg of the clothes moth but are more of a cream in color. Eggs of this mite are semi-translucent and similar in shape to the clothes moth eggs but they are only about one-tenth as large. Clothes moth cultures infected by this mite, and presumedly other species which normally deposit a single large egg, need not be destroyed.

Details of Method

If a deep nap type of wool is exposed to clothes moth adults for not over four days, many eggs will be deposited on it. These, together with mites and their eggs, are easily removed by brushing and shaking. If the collection is spread out on carbon paper and a low wattage light placed near it, living mites can be seen easily and killed as they crawl away. Mite eggs are removed by a 60 mesh copper screen. A combination of tapping the frame and brushing the eggs about with a camel hair brush has been most effective. A binocular-microscope, or other means of magnification, should be used to check on the efficiency of the screening.

* Courtesy of Dr. C.F.W. Muesebeck and Dr. H.E. Ewing.

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By this procedure, certain predacious mites can be eliminated completely from clothes moth cultures. An additional factor is that when the routine is completed, clothes moth eggs are clean of foreign matter and a definite quantity can be measured. An ordinary centrifuge tube or any other graduated tapered glass tube will suffice. If a definite quantity of media is supplied for a definite quantity of eggs, cultures of clothes moths will develop uniformly in regard to time, and both larvae and adults will be relatively uniform in size.

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TREATMENT OF SEED GRAIN IN CANADA TO CONTROL DISEASE RECOMMENDED BY THE DOMINION DEPARTMENT OF AGRICULTURE

EDITOR'S NOTE:- This article is a contribution from the Extension Division of the Dominion Department of Agriculture, Ottawa, Canada.

The health of seed grain is a factor of first importance in determining the yield and quality of the crop. When all of the other factors such as fertility, moisture and temperature are favourable for successful production, the crop may be a failure because of parasites which are seed-borne, or because of natural or artificial injury of the seed. Experiments conducted at the Dominion Laboratory of Plant Pathology at Saskatoon, states H. W. Mead of that Laboratory, have shown that plump seed which is relatively free of disease produces better crops than low quality seed under the same conditions.

Examination of many samples of seed grain from different parts of Saskatchewan over a period of years has shown that some are relatively free of disease organisms. It has been established by experiment that no increase in yield can be expected ordinarily from treating healthy seed, but substantial benefits do accrue from treatment of diseased grain. As a preliminary precaution it is always advisable to have a germination test made and facilities for such are provided by the Dominion Department of Agriculture in each province.

Ways of Ridding Seed of Parasites

It is possible to rid seed of most of the parasites it may carry, and there are several ways of doing it. Some fungi like that of loose smut of wheat are established deep in the seed and the difficult hot water treatment is required to kill them. A more practical method of dealing with such a disease is the use of a seed plot which may be rogued. The fungi which cause bunt of wheat, the smuts of oats and covered smut of barley are carried as spores and vegetative structures on the surface of seeds or inside the chaff. These fungal particles may be killed by chemical treatment of some sort. Formaldehyde still ranks among the foremost liquid treatments because of its cheapness and its general effectiveness, in spite of its tendency to injure the seed. To be effective, it must be properly applied, otherwise its benefits do not compensate for the injury it causes. It will control effectively the smuts of oats, bunt of spring wheat and covered smut and black loose smut of barley. It is not advisable to treat shrivelled and other low grade seed with formaldehyde. Certain copper dusts, such as copper carbonate and basic copper sulphate will prevent bunt smut of wheat in the absence of soil infestation and will control some of the other diseases as well. Copper dusts, on the whole, are relatively ineffective against barley and oat smuts except in hulless varieties.

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Organic Mercury Dusts Effective

There are organic mercury dusts on the market which are very effective in the control of bunt of wheat, the smuts of oats, covered smut and black loose smut and the stripe disease of barley. These dusts will destroy also the seed-borne bacteria which cause halo blight and leaf spot of oats, and black chaff of wheat. They destroy seed-borne fungi which cause seedling blight and if applied not more than a few days before seeding, provide a certain amount of protection against soil-inhabiting organisms that frequently attack germinating seeds. A dusting machine of some kind is necessary for the proper application of dust treatments.

Seed treatments do not control stem or leaf rust of cereals. However, any treatment which will aid a quick germination and rapid growth has indirect benefits in the event of rust attacks. This applies also to insect damage, particularly wireworms.

Information on seed treatments may be secured from the Dominion Laboratories of Plant Pathology at Winnipeg, Saskatoon and Edmonton.

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EQUIPMENT OF A TYPICAL PEST CONTROL RESEARCH LABORATORY TO BE EXHIBITED BY DU PONT AT THE NEW YORK WORLD'S FAIR

EDITOR'S NOTE:- Readers are cordially invited to visit the "Wonder World of Chemistry", in the Du Pont Exposition Building, at the New York World's Fair.

Some of the essential equipment of a typical pest control laboratory will be operated at the E. I. du Pont de Nemours & Company's Exhibit at the New York World's Fair. This laboratory will form part of that group of exhibits in the Du Pont Building designed to illustrate laboratory control methods in use in applied research.

Experimental spraying of plants will be demonstrated by the standard turntable method and sprayed and unsprayed plants in feeding cages will be exposed to several kinds of the more common and injurious leaf-eating insects. A reduced model of a "Peet-Grady" lethal chamber will be operated to show the method of developing and evaluating more efficient household insecticides. Several common insect pests will be shown imbedded in "Lucite" discs, the face of these being convex so as to give an appreciable magnification.

Cultures of fungi which cause some of the more destructive seed-borne, soil-infesting and wood-rot diseases will be on exhibit in connection with specimens illustrating the benefits of proper treatments. In conjunction with wood treatments it is also planned to maintain a large termite colony.

Appropriate lectures will be given at frequent intervals to point out the necessity and value of pest control and to explain the operations of the laboratory methods demonstrated.

It is believed that an interesting and spectacular feature of this exhibit will be a recording of the feeding sounds of such insects as Japanese beetles, Mexican bean beetles, and army worms amplified about 100,000 times.

A cordial invitation is extended to all entomologists, plant pathologists and others interested in the control of insects and plant diseases to visit the Du Pont Building when they come to the Fair. Dr. M. D. Leonard will have charge of the operations of the Pest Control Exhibit and will be on hand to answer questions.

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COURSES IN THE PRACTICAL USES OF EXPLOSIVES OFFERED ENGINEERING AND FORESTRY STUDENTS AT STATE COLLEGES

EDITOR'S NOTE:- Just as the use of explosives is taught in mining schools, there would seem to exist, as Mr. Livingston points out, a real need for explosives courses at colleges with courses in forestry and engineering.

By L. F. Livingston, Manager,
Agricultural Extension Division,
E. I. du Pont de Nemours & Co., Inc.,
Wilmington, Delaware.

When the Civilian Conservation Corps was organized and put into effect a country-wide program of drainage, soil-erosion control and forestry work, there was early recognition of the need for men familiar with the uses of dynamite. It was necessary, therefore, to secure instructors skilled in the handling of explosives.

Probably never before has there been the teaching of explosives practices on such a large scale. The courses have been continued without interruption, due to necessity for training the new men who are constantly being enrolled.

As in the case of the C. C. C., all too frequently it is found in forestry, civil and agricultural engineering and some other fields that college graduates have meagre or no knowledge of how to handle explosives safely, efficiently and economically.

Credit Courses in Explosives

In 1924 an instructor in the Michigan State College decided that since explosives were of vital importance to the farmers of Michigan, their uses should be taught the students of the institution. He went to the deans of agriculture, forestry, and engineering, and proposed a two-credit course, with two hours of lecture work, and seven hours of field work for a six-day period during the spring vacation. It was believed, however, by the college authorities that students would not take the work.

This instructor then obtained permission to put the matter up to the students. Much to the gratification of the deans, 52 students expressed a desire to stay at college during the spring vacation, and take the course.

That was the start of a two-credit course which has been offered regularly at the Michigan State College. The course has proved increasingly popular. For

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the past five years, students have been turned away because facilities were not available for handling more than 50 students in the field on this type of work.

About five years ago, a similar course was started at Oregon State College, but on a somewhat different basis, in that the lecture work is given in the regular curriculum and the field work in all-day Saturday laboratory periods.

Limited Work Offered at Other Institutions

Michigan and Oregon are the only colleges which give a regular credit course in the use of agricultural explosives. Some other institutions offer limited work, and some field work. Even so, the possibilities of explosives courses are apparent from the fact that the classes are always crowded.

Teaching the use of explosives would seem to be logical at all institutions where courses are offered in civil engineering, agricultural engineering, forestry and the like.

The use of explosives is indispensable in highway building, railroad construction, demolition work, various types of construction, land clearing, drainage and for other purposes. Yet, engineers are all too frequently unfamiliar with the handling of explosives. Certainly, the graduate in engineering is almost wholly inexperienced in the fundamentals of explosives uses when he leaves college.

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SIMPLE METHODS FOR PREVENTING DECAY OF FENCE POSTS AND FOR PRESERVING STANDING AND FELLED GREEN TREES

EDITOR'S NOTE:- These excerpts are from a bulletin, "Pertinent Facts on Salvaging New England Timber," issued by the United States Forest Products Laboratory, Madison, Wisconsin. While zinc chloride was used in the work reported here, a number of experimenters have found that chromated zinc chloride is the preferred salt for timber treatment.

Fence posts, when freshly cut and in the thoroughly green condition, can be treated with zinc chloride solution by the "tire-tube" process, which consists in fastening a section of a tire inner tube over one end of the post, pouring in a measured amount of zinc chloride solution, and allowing the solution to run into the sapwood of the post. This inexpensive treatment can be expected to make posts of nondurable species last about as long as good cedar or chestnut posts without treatment. Details of the method are given in Forest Products Laboratory mimeograph R1158 (free).

Moderate protection can be obtained by the steeping method, which consists in soaking green or dry, peeled or sawed, material for a week or more in a solution of zinc chloride or similar preservative. Steeping will usually be less effective than hot-and-cold bath or tire-tube treatment. The method is described in Forest Products Laboratory mimeograph R621 (free).

Standing or freshly felled green trees can be satisfactorily treated for rustic structures or similar purposes by methods developed by the U. S. Bureau of Entomology and Plant Quarantine. For standing trees, a specially formed groove is cut around the tree and covered with a tight gasket, after which preservative in water solution is siphoned into the groove from a container attached to the tree. The preservative is drawn up into the sapwood of the tree by the evaporation of moisture from the foliage. Freshly felled trees with their branches on, if not too large, can be stood in a container of preservative or a section of tire-tube can be fastened over the butt end and filled with preservative solution as the tree lies on the ground. The preservative is then drawn into the sapwood, as in the standing tree. These three methods are described in a mimeograph entitled "A method for preventing insect injury, to material used for posts, poles, and rustic construction," available on request from the Bureau of Entomology and Plant Quarantine, Washington, D. C.

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